



# Energy/Water Sustainability

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Electric Power Research Institute

CEC Energy-Water Relationship Workshop

Sacramento, CA

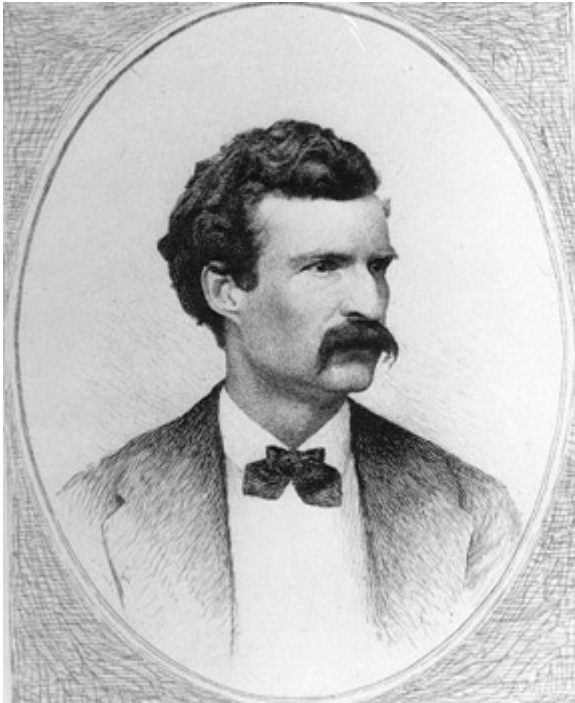
January 14, 2005

# Ben Franklin



- When the well's dry,  
we know the worth of  
water.

# Mark Twain



- Whiskey's for drinking. Water's for fighting over.

# John Donne: Meditation XVII



- *All mankind is of one author, and is one volume; when one man dies, one chapter is not torn out of the book, but translated into a better language; and every chapter must be so translated...As therefore the bell that rings to a sermon, calls not upon the preacher only, but upon the congregation to come: so this bell calls us all: but how much more me, who am brought so near the door by this sickness....No man is an island, entire of itself...any man's death diminishes me, because I am involved in mankind; and therefore never send to know for whom the bell tolls; it tolls for thee."*

# Water Resources Sustainability Initiative

- 32 States reported drought conditions in March 2002.



# GAO Survey of State Water Managers

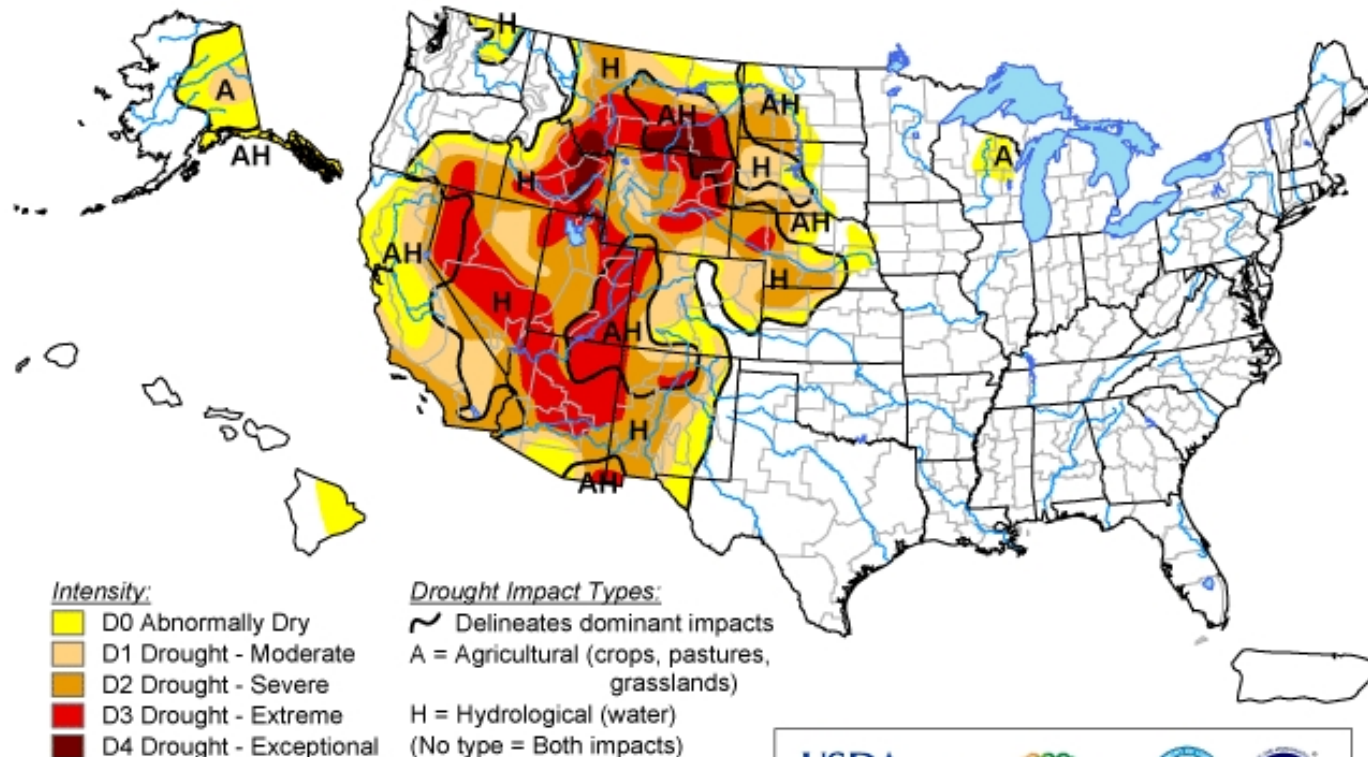
- Under drought conditions, all 45 state water managers who responded to the GAO predicted water shortages that could be "accompanied by severe economic, environmental and social impacts."
- Water managers in 36 states surveyed by the GAO said they anticipate water shortages in the next 10 years under "average water conditions."



# Recent Drought Conditions

## U.S. Drought Monitor

September 7, 2004  
Valid 8 a.m. EDT



### Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

### Drought Impact Types:

- Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)
- (No type = Both impacts)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

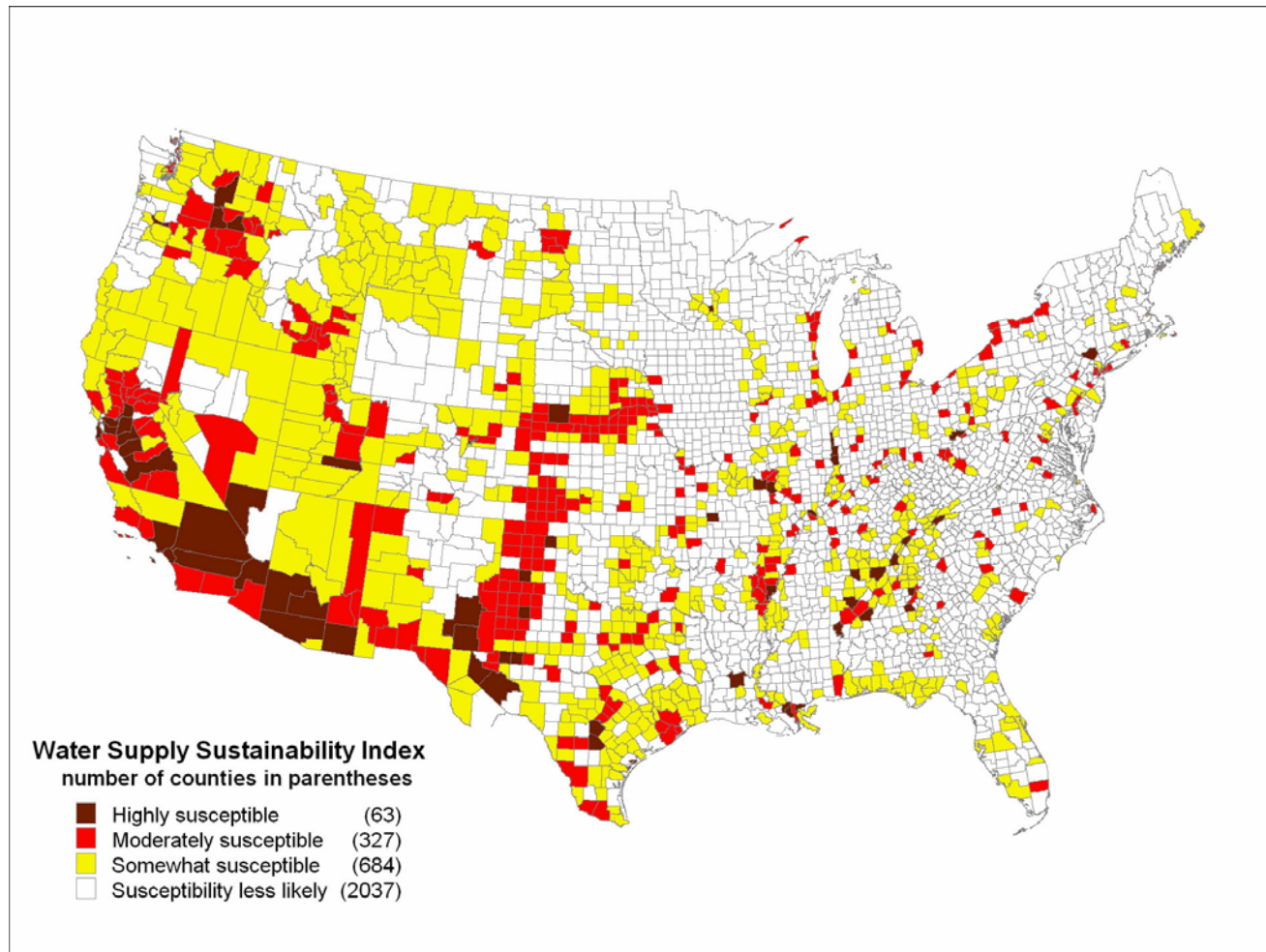
<http://drought.unl.edu/dm>



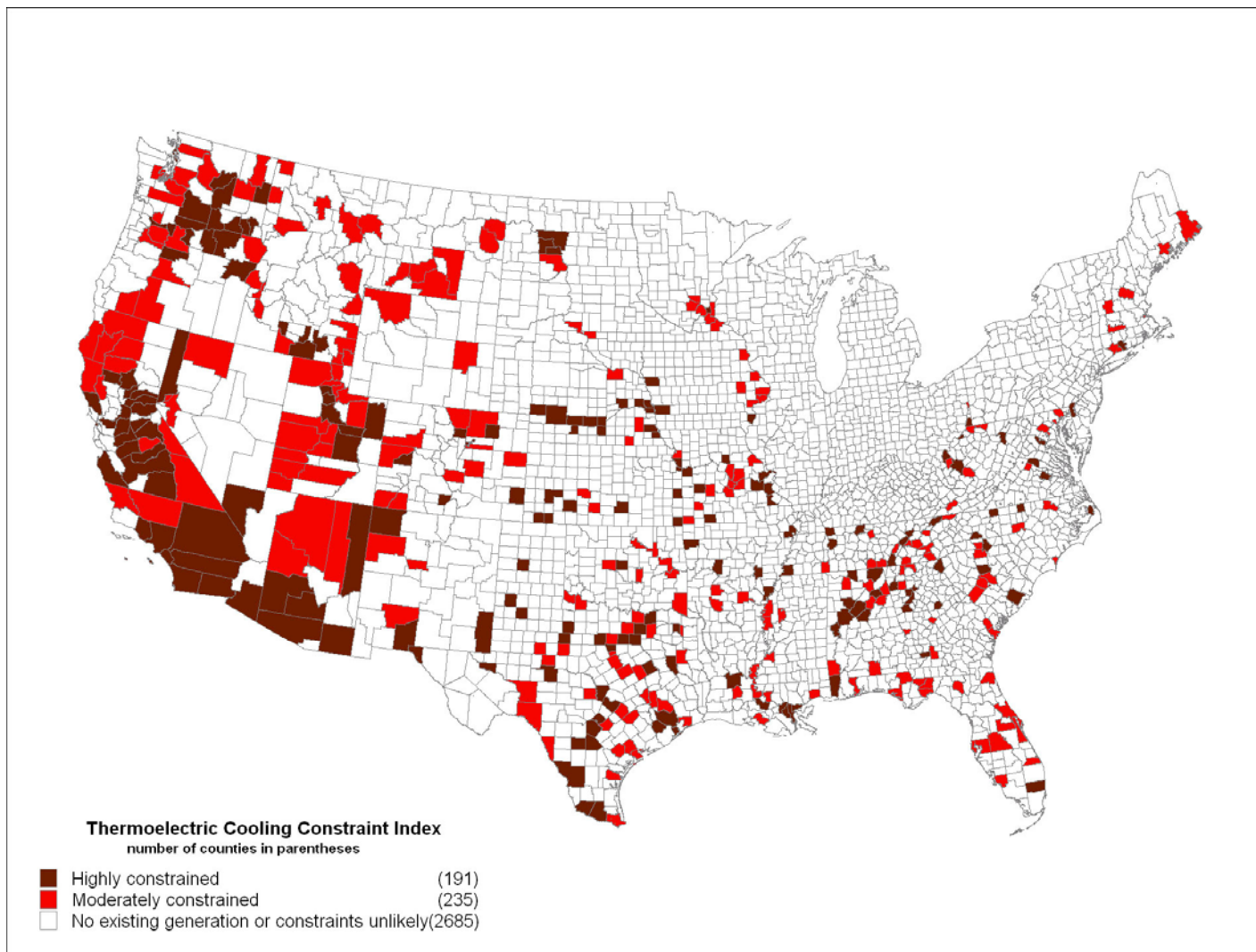
Released Thursday, September 9, 2004

Author: Doug Le Comte, CPC/NOAA

# Water Supply Sustainability Index (2025)

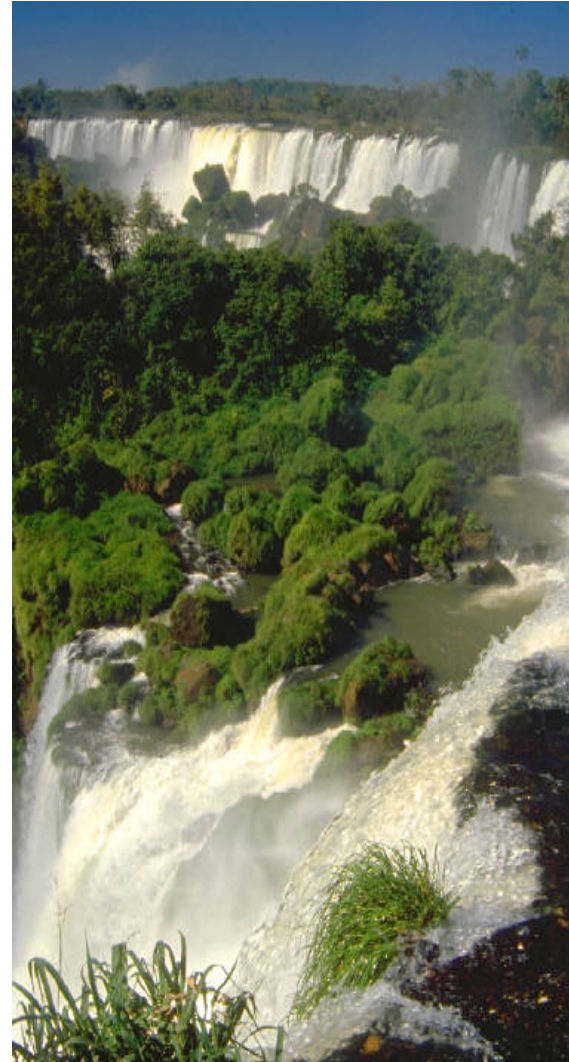


# Thermoelectric Cooling Constraint Index



# Water Is a Critical Resource

- Fast growing demand for clean, fresh water
- Increased demand for environmental protection and enhancement
- All regions of US vulnerable to water shortages
- Water availability determines
  - Electricity supply and demand
  - Electricity grid topology
  - Societal and economic infrastructure sustainability



# EPRI Water Resources Sustainability Initiative



- Science and technology research
  - Watershed hydrology and biogeochemical cycling
  - Ecological response – eco-indices
  - Watershed management decision support models
  - Advanced cooling technologies
  - Use of degraded water
- Integration of micro and macro approaches
- Regional public-private partnerships
  - CEC PIER Program
  - NETL (USDOE)
  - Power Companies

# Reports

- Water & Sustainability (Volume 1): Research Plan (EPRI 1006784, 2002)
- Water & Sustainability (Volume 2): An Assessment of Water Demand, Supply and Quality in the U.S. – The Next Half Century (EPRI 1006785, 2002)
- Water & Sustainability (Volume 3): U.S. Water Consumption for Power Production – The Next Half Century (EPRI 1006786, 2002)
- Water & Sustainability (Volume 4): U.S. Electricity Consumption for Water Supply and Treatment (EPRI 1006787, 2002)
- Use of Degraded Water Sources as Cooling Water in Power Plants (EPRI 1005359, 2003) – Cosponsor CEC PIER Program
- Spray-Cooling Enhancement of Air-Cooled Condensers (EPRI 1005360, 2003) – Cosponsor CEC PIER Program
- A Survey of Water Use and Sustainability in the U.S. with a Focus on Power Generation (EPRI 1005474, 2003)
- Comparison of Alternate Cooling Technologies for U.S. Power Plants: Economic, Environmental and other Tradeoffs (EPRI 1005358, 2004)
- The Formation and Fate of Trihalomethanes in Power Plant Cooling Water Systems (EPRI 1009486, 2004) - Cosponsor CEC PIER Program

# ZeroNet Water-Energy Initiative

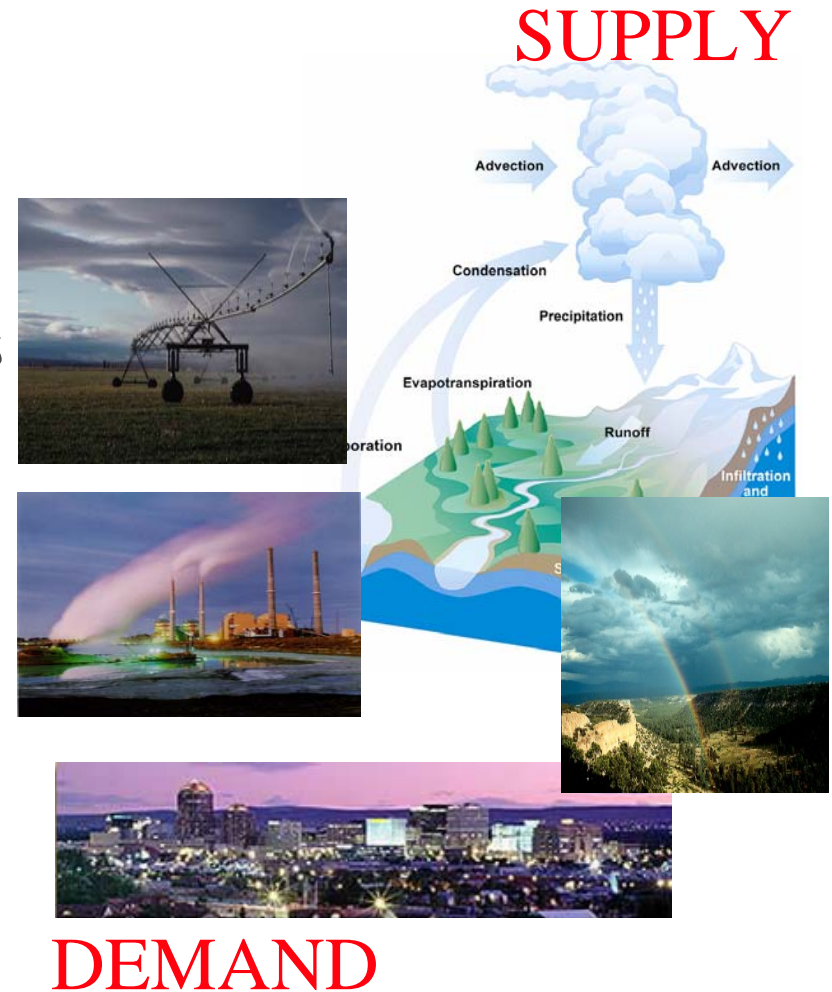


# ZERONET

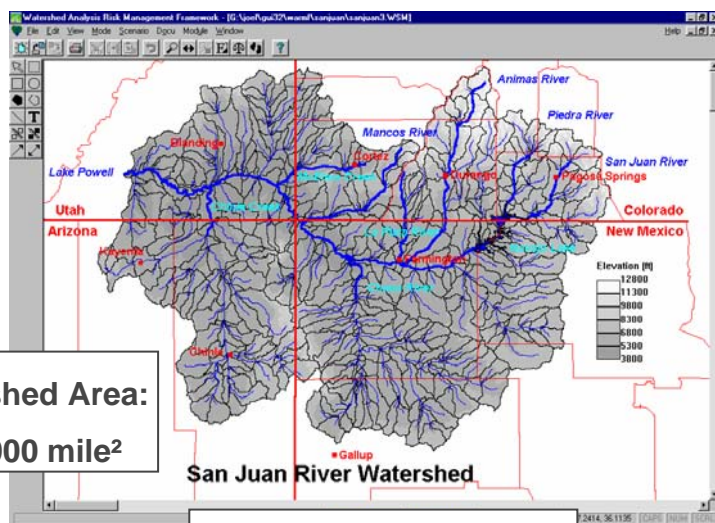
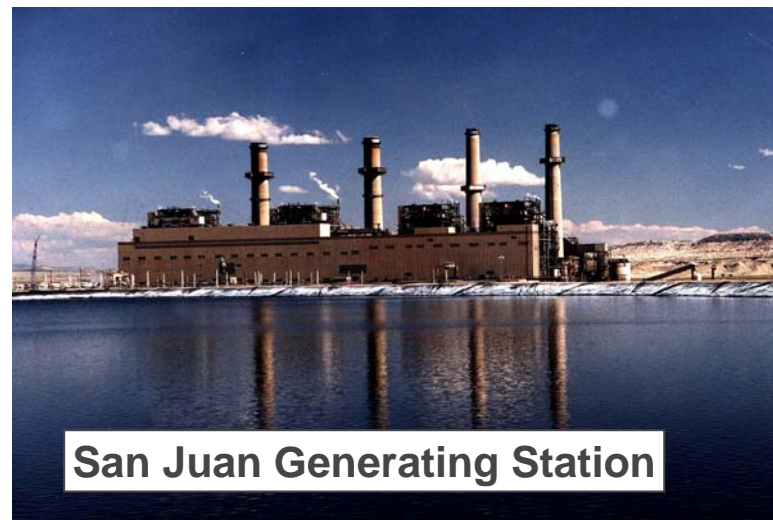


# Power Generators Face Drought Related Challenges

- Recent drought in the San Juan Basin drove water supplies to their lowest level ever
- The San Juan Generating Station uses 22,000 acre feet/year of San Juan River Water
- Power producers face major financial penalties if water restricts plant efficiency
- The power user will pay the price



# San Juan River Basin



# Major Stakeholders In the San Juan Basin



**Razorback Sucker**

- Navajo Nation – NIIP, Hogback, Fruitland, Navajo-Gallup
- Jicarilla Apache Nation
- Colorado Tribes – Southern Ute, Ute Mountain Ute, Animas-La Plata Project
- San Juan Chama Project (No ESA Section 7 consultation on San Juan effects)
- Municipalities/ San Juan Water Commission/ISC & OSE
- Industrial
- Non-Indian Agricultural
- Fly Fishermen
- Endangered Fish Species
- The Feds – USBR, USFWS, BIA, USFS, BLM

# Solving the problem

## Requires Science and Technology

Demonstration,  
Test Beds, Outreach

Policy, Economic and  
Market Analysis

Prediction &  
Decision Support

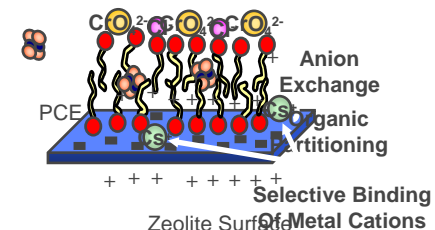
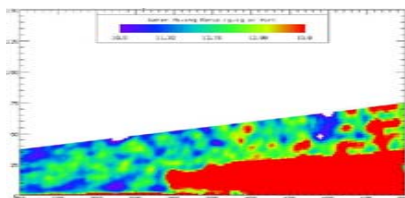


Monitoring &  
Measurement  
Science  
& Technology

Advanced  
Cooling Technology

Conservation, Efficiency  
& Renewables

Degraded Water  
Treatment and Use  
Technology



# Management Questions

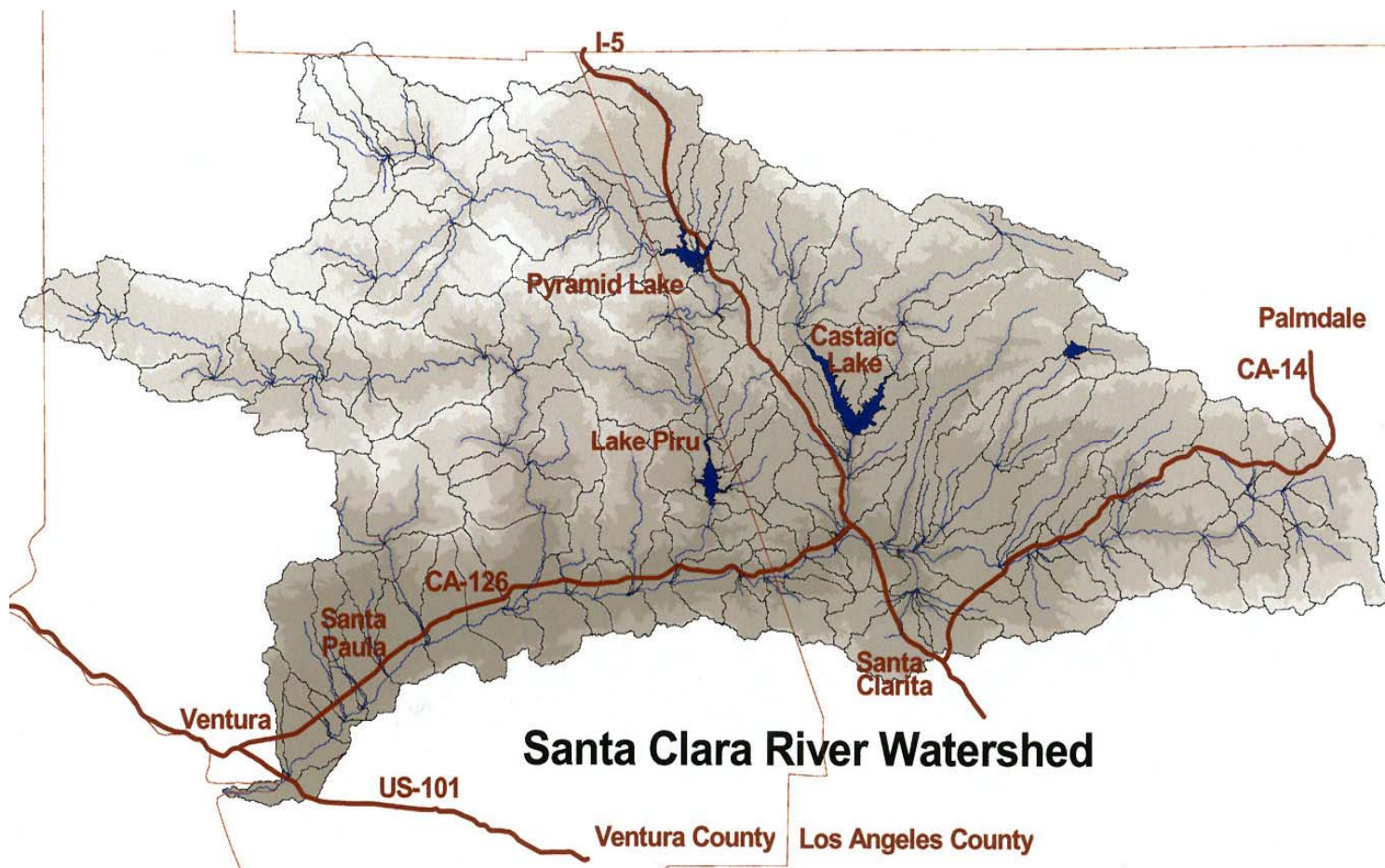


- What additional water supplies become available as a result of advanced cooling technologies, use of degraded water, water banking?
- What is the effect of power production on water quantity and quality?
- How will regional growth affect hydrology and water quality?
- How does climate change affect long-term water supplies?

# Santa Clara Watershed TMDL Analysis

- 2003 Annual Water Quality Reward
  - Steering Committee of Santa Clara River Nitrogen TMDL
  - Los Angeles Regional Water Quality Control Board
  - WATER QUALITY STEWARDSHIP
- Stakeholder Steering Committee
  - Los Angeles Regional Water Quality Control Board
  - Cities of Santa Clarita, Fillmore, and Santa Paula
  - Los Angeles County Sanitation District
  - Newhall Land and Farming Company
  - United Water Conservation District
  - Ventura County Supervisors and Department of Public Works
  - Los Angeles County Department of Public Works
  - Ventura County Flood Control
  - Ventura County Farm Bureau
  - Friends of the Santa Clara River
  - California Department of Water Resources

# Santa Clara River Watershed

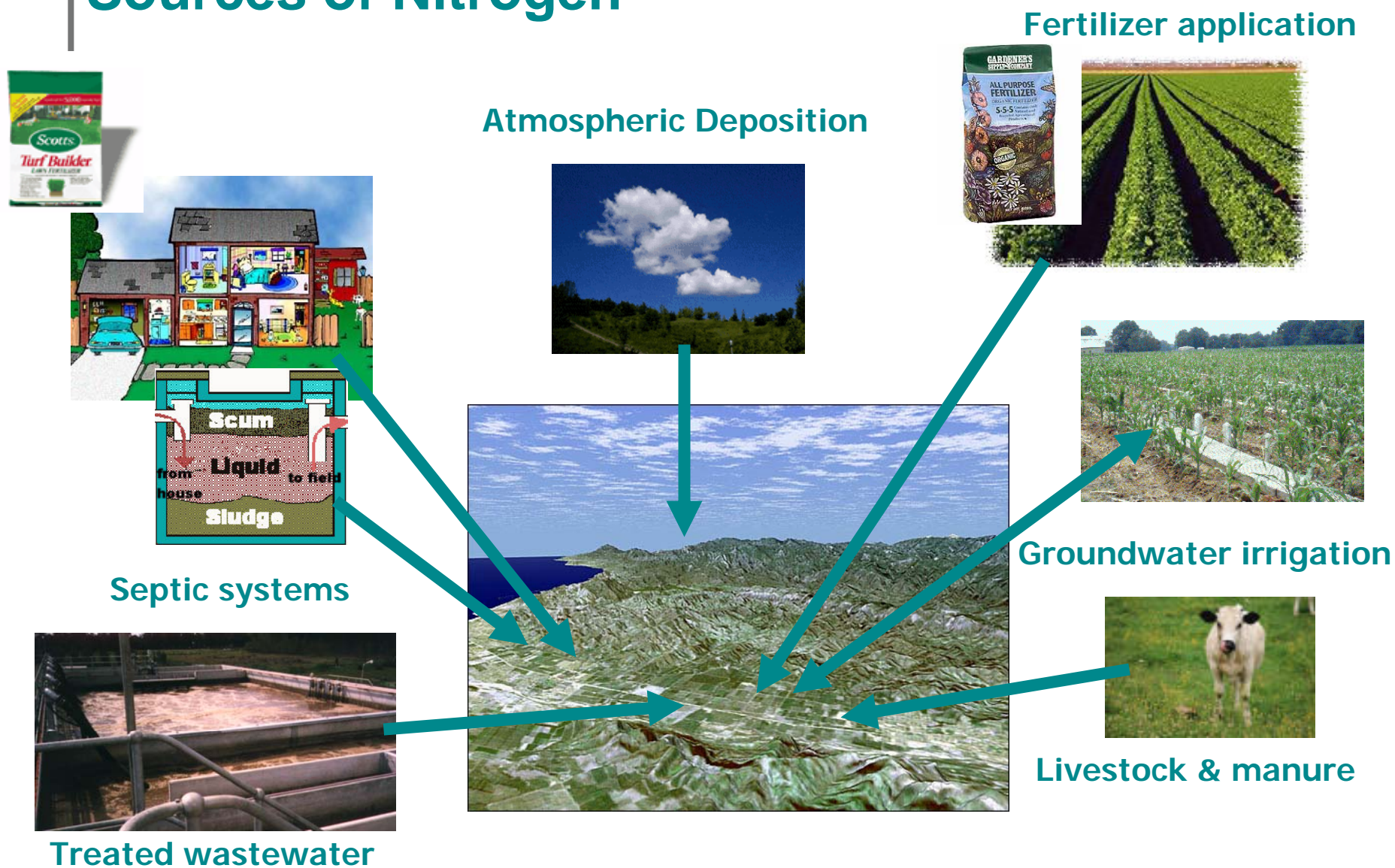


# Santa Clara River Water Quality Issues

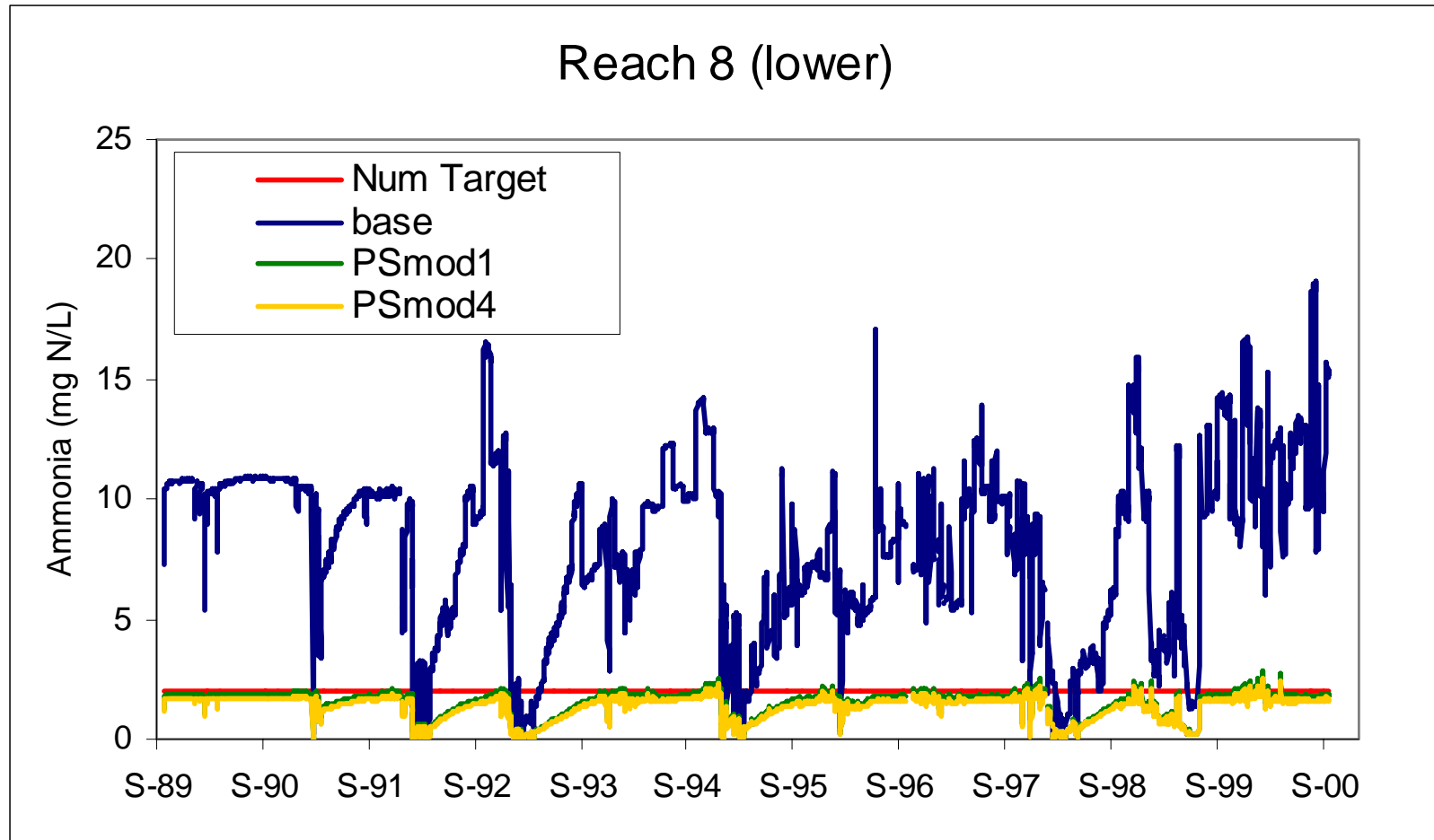


- Upper watershed
  - Ammonia and nitrate/nitrite
  - Low dissolved oxygen and organic enrichment
- Lower watershed – Ammonia and nitrate/nitrite

# Sources of Nitrogen



## Reach 8: Ammonia



# CA Energy/Water Research Consortium

- California Energy Commission
- California Power Companies
- California Department of Water Resources
- Lawrence Livermore National Laboratory
- Lawrence Berkeley National Laboratory
- University of California
- Electric Power Research Institute